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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

ANDERSON, MATTHEW A

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 02/19/2003

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/787,062

Applicant(s)

LESKELA ET AL.

Examiner

Matthew A. Anderson

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 December 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-35 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-35 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over DiMeo Jr. et al. (US 5,972,430) in view of Kirlin et al. (US 5,453,494).

DiMeo discloses a CVD method for forming multi-component oxide layers. From Fig. 2 is clear that this method is a pulsed method of feeding the reactants into the reactor the oxidizing them with iterations until the final thickness is deposited. The CVD method is described as an equivalent variant to the related ALE (atomic layer epitaxy) method. The multi-component oxides are described in col. 7 as including BST (barium strontium titanate) The examiner notes that the disclosure of Kirlin et al is incorporated in full into that of DiMeo Jr. et al's. (col. 8 line 53) to describe the chemical Ba and Sr precursors of use. In example 1 in col. 11 is the disclosure of using Si substrates for the growth of BST. In col. 7 lines 1-30 the substrate can be any employed in thin film processing. Oxidants include, according to col. 9 lines 1-15, oxygen, ozone, nitrous

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oxide, nitric oxide, nitrogen dioxide, water vapor, hydrogen peroxide vapor, and mixtures thereof. Plasma activation of the precursors is suggested.

DiMeo et al. does not explicitly suggest using at least one cyclopentadienyl compound of strontium and/or barium in their deposition process,

Kirlin et al. discloses metal complexes of use in metal-organic CVD (MOCVD). The source reagents of Kirlin have a general formula of MA_yX as described in the abstract. M is a metal such as Ba or Sr. A is a monodentate or multidentate organic ligand, y is a 2 or 3, X is a monodentate or multidentate ligand coordinated to M and containing one or more atoms independently selected from C, N, H, S, O, and F. The ligand A may be selected from the beta-diketones, cyclopentadienyls, alkyls, perfluoroalkyls, alkoxides, perfluoroalkoxides, and Schiff bases. This is more thoroughly explained in col. 4 lines 55+, col. 5 lines 1-62, and col. 8 lines 57+ col. 9 and col. 10 lines 1-20. In col. 8 lines 15-57 the temperature for convenient flow of the precursors of Kirlin is given as less than 200°C and their decomposition is given as over 400°C. This is given as important to reduce premature decomposition in the piping. In col. 43, the precursor gas $Ti(OP)_4$ is suggested for $BaTiO_3$ deposition

It would have been obvious to one of ordinary skill in the art at the time of the present invention to combine the above references because DiMeo et al. incorporates Kirlin fully by reference.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to grow by an ALE pulse process an oxide thin film on a Si substrate using the claimed precursor compounds of claim 1 because DiMeo et al. discloses the

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equivalence of ALE and CVD and Ti isopropoxide (a known alkoxides; see col. 12 lines 1-10), and Kirlin et al. suggests the using of cyclopentadienyl compounds of Ba and or Sr and reactive oxygen precursors such as ozone or oxygen.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to grow dielectric films such as BST or BT (barium titanate) because both are disclosed in both references.

Claim 3 would have been obvious to one of ordinary skill in the art at the time of the present invention because of Fig. 2 of DiMeo Jr. et al.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to optimize the thickness obtained because Fig.2 of DiMeo directly suggests this and such optimization would have been achieved with only routine experimentation.

It would have been obvious to optimize the process parameters including the concentrations of the precursors because of the stoichiometry of the desired Ba or Sr containing titanate compound.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the described cyclopentadienyl because the described MAYX of Kirlin et al. suggests the $\text{M}(\text{Cp})_2$ or $\text{M}(\text{Cp})_2\text{Ln}$ as described in the claim. The bonding of the cyclopentadienyls would also have been expected since Kirlin discloses precursors made up of two or three cyclopentadienyls which are mono or multi dentate and X is disclosed as having one or more of the atoms from the group C,N, H,S, and F.

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It would have been obvious to one of ordinary skill in the art at the time of the present invention that amino, alkyls, hydrocarbons, amines, polyamines, bipyridines, and other ligands be incorporated into the cyclopentadienyls precursors because such ligands are disclosed by Kirlin et al.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to optimize the film deposition temperature because such is suggested by Kirlin et al. and such optimization would have been achieved with only routine experimentation.

3. Claims 25-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over DiMeo and Kirlin et al. as applied to claims 1-24, 27 above, and further in view of Maiti et al. (US 6,020,024).

DeMeo and Kirlin et al. are described above.

They do not disclose annealing of oxide dielectrics.

Maiti et al. discloses the annealing of BST to fully oxidize the metal oxide while preventing adverse oxidation of the substrate.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to combine the anneal of Maiti et al. with that of the above combination because then one of ordinary skill would be assured of full oxidation of the metal oxide while avoiding substrate corrosion.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to optimize the temperature of the annealing because annealing is

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nothing more than the application of heat under certain conditions and such optimization would have been achieved with only routine experimentation.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 28-35 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP § 2172.01. The omitted steps are: oxidant introduction between strontium and titanium metal precursor introduction. Claims 32-33 are not clear as to when the pulsing occurs and if there is to be purging between the pulses.

6. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

7. Claim 31, 34, 35 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The Specification only

describes the deposition of Sr-O and Ti-O alternating layers. Thus, no support is given for the addition of Ba to the layers.

Response to Arguments

8. Applicant's arguments filed 12/18/2002 have been fully considered but they are not persuasive.

The argument that each and every aspect of the process is not taught by the references is not convincing. DiMeo et al col. 1 lines 43-60 discloses that ALE is a form of CVD deposition useful of multi-component oxide deposition

The argument that the precision of the claimed invention is of one molecular layer and DiMeo is much more since it teaches 5 to 100 angstroms of thickness. This merely improves the examiner's case in that we are talking about a multi-component oxide layer composed of atoms of Ba, Sr, Ti, and O which have ionic radii on the order of the lower limit. (Official notice is given that atomic radii in angstroms are well known.) The resultant unit cell must therefore be 'about 5 angstroms'.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e. self controlled nature of ALE) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

The deduction of the last paragraph does not take away the fact that DiMeo teaches about 5 angstrom thick layers -- on the order of a molecular layer thickness.

Conclusion

1. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew A. Anderson whose telephone number is (703) 308-0086. The examiner can normally be reached on M-Th, 6:30-5.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on (703) 308-3836. The fax phone

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numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

MAA
February 13, 2003


BENJAMIN L. UTECH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700